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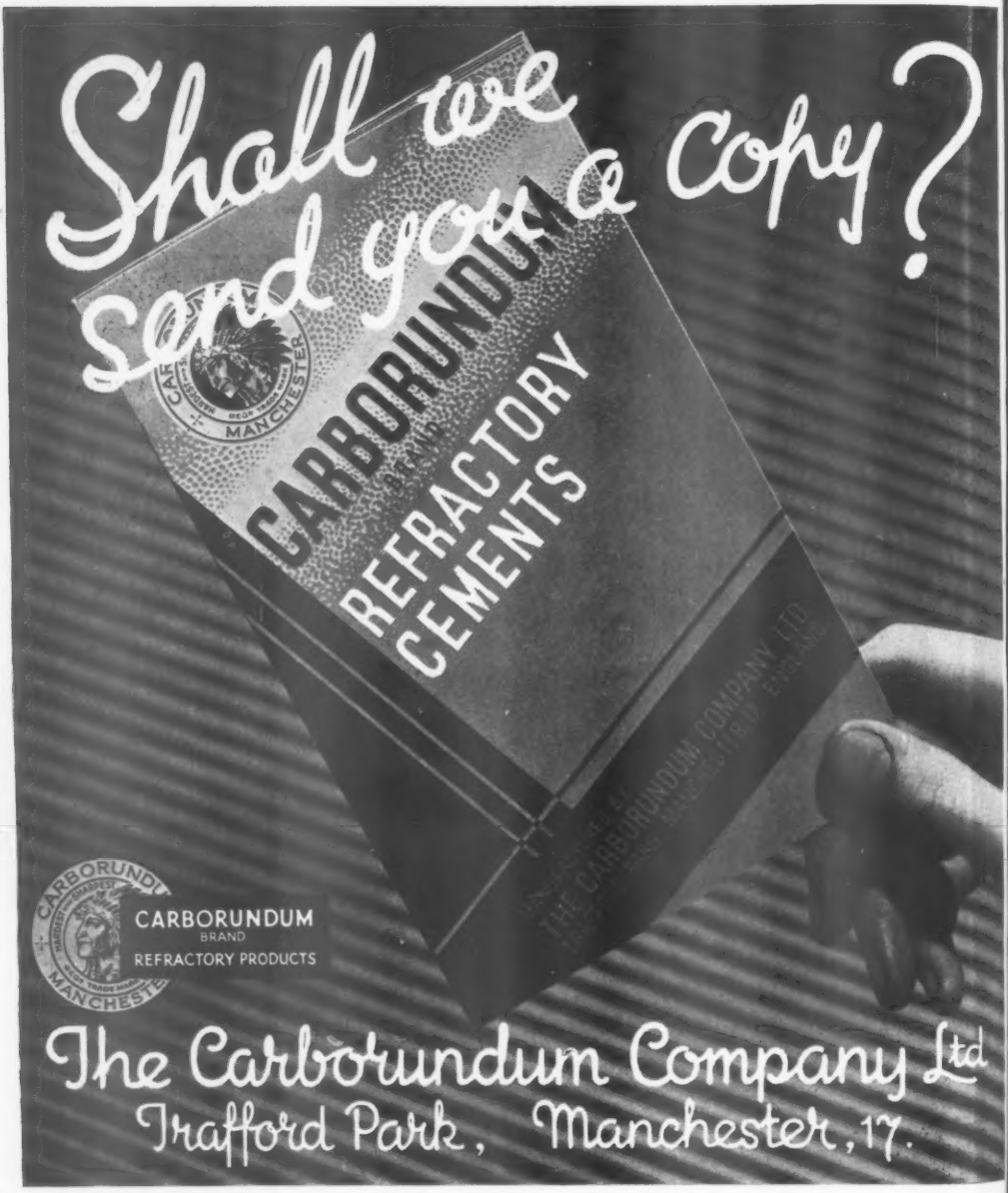
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Post-War Technical Institute Activities

Mr. H. W. Lockwood in his presidential address to the London Branch of the Institute of British Foundrymen raised the important subject as to the future of technical institutes in the post-war period. Those associations which have, during the war, shown enterprise and initiative, often under the most adverse circumstances, will find that they have to cater for a very much enlarged membership, reinforced as it will be by demobilised service men. Will the members who now are satisfied as to the great potentialities of the professional institutes be satisfied with one or two general meetings per annum, plus four or five monthly lectures, a dinner and works visit as the annual programme? This we doubt, and we envisage an extended programme to embrace study groups for specific aspects of founding; two or more specialised courses of lectures in the larger centres to cater for local industries; an increase in the number, and added interest in the work of various technical committees, and a wider interest in general and vocational training. To achieve the first two, it seems desirable for an appropriate officer to invite all members in his area interested in a specific subject, say, light alloys or die-casting, to an informal round-table discussion, and after giving his guests a talk on the facilities available, leave to the individuals present to organise activities of the type which will satisfy their requirements. Such efforts will not detract from the interest aroused by the standard type of general technical meeting, for, with their specific needs being well catered for, their enthusiasm for foundry practice as a whole will be deepened. Mr. Lockwood urged his audience to turn their attention to good housekeeping—with special attention to the kitchen—in the concerns under their charge, and his reference to the care bestowed upon the stables by certain firms still using horses for transport at the pride they have in winning cups in the May Day Processions contrasted strangely with their lack of interest in the physical condition of their moulders, was particularly apposite. Thus, he would have added to the list of activities the dissemination of knowledge as to how to keep the ordinary foundry operatives in the pink of condition. We are afraid that unlike horses, men have free time to pursue their hobbies, which may result in their squandering their money on hops, harlots or horses to the detriment of their physique! All that the foundry executives can do is to provide a good stable and proper provender, and these we admit can with advantage be the subjects of interesting informative lectures. The increased activities of the professional institutes has already brought about a certain amount of competition, and the future will tend to intensify it, but if conducted in a proper spirit nothing but good can come of it. In the words of Dr. H. W. Gillett: "Hell, can't folks compete without fighting." What we have written above represents our own views, and is in no way inspired by any of the organisations of which we have the honour to be the official organ.

American Malleable Castings.—American production of malleable iron castings in the first six months of the current year amounted to 419,726 short tons, exceeding the output in the similar 1942 and 1941 periods, which totalled 396,022 tons and 415,938 tons respectively, according to the Bureau of the Census, Department of Commerce. Output in June of this year of 69,092 tons showed little change from the 69,959 tons reported in May, but was up substantially from the 59,990 tons produced in June of 1942. Bookings in the first six months of 488,242 tons were up sharply from the 404,965 tons booked in the like 1942 period, but show little change from the 486,481 tons reported in the first six months of 1941.

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NOTES FROM THE BRANCHES

Bristol and West of England Branch.—The Branch-President opened the October meeting of the Branch at Bristol by announcing that Mr. Frank Hudson, who was to have presented an atlas of defective casting, was unavoidably absent, due to illness. In his place, Mr. A. Logan, of the London Branch, had kindly offered to deputise. MR. LOGAN said the Institute realised the need for an atlas of defects by which certain forms of casting defects could be readily recognised. Accordingly a collection of photographs submitted by various firms had been classified as typical of the various defects to be described. This atlas was now being shown at the various Branches throughout the country, starting with the Bristol Branch, for the comments of the members on the suitability of the titles chosen for the various photographs and for any suggestions as to alternative descriptions which the members might feel were more appropriate. The faults in castings could roughly be divided under three heads:—(1) Due to metal, caused by incorrect melting practice, gassy metal, etc.; (2) due to method of gating, such as dross inclusions, shrinkage, etc.; and (3) due to moulds, such as incorrect mould dressings, etc.

Mr. Logan then showed 37 slides and discussion was invited on each individual slide. The meeting closed with a vote of thanks, proposed by Capt. Hunter and seconded by Mr. Rennie.

London Branch.—Mr. H. W. Lockwood presided over a well-attended meeting called with the same object as the one reported above for Bristol. Mr. Logan again sponsored the presentation of the atlas, and animated discussion followed the showing of each slide. The lecturer was accorded a very hearty vote of thanks on a propostion made by Mr. G. C. Pierce (Past-Branch-President) and seconded by Mr. J. F. Kayser (Vice-President).

East Midlands Branch and Lincoln Section.—On October 9, by courtesy of the directors of Harrison & Company (Lincoln), Limited, a large gathering of members visited the malleable-iron foundries of this works. Following tea, served in the works canteen, Mr. W. H. Smith and Mr. Butters thanked the hosts for their hospitality, Mr. Bryan, the works manager, responding. The company then adjourned to hear Mr. Bingley, of the Lincoln Section, deliver his presidential address, in which he reviewed the progress made locally and commented on the change in munitions of war caused by the successful termination of desert warfare; the need for the training of foundrymen now in the Services on their demobilisation, and correlated this with the general provisions of the White Paper on Education.

After being thanked by Dr. Walter and Mr. Harbach, he called on Mr. Roxburgh to present his Conference Paper on "Some Aspects of the Production of Malleable Iron Castings." The discussion which followed centred around synthetic sands, and the use of atmospheric pressure for gating. The Williams method, popularised by Taylor and Rominski, was referred to by Mr. Goodwin as a "landmark in the history of malleable castings." This speaker did not agree that the present mechanical requirements for malleable as specified were too low, but thought the existing specification could be improved as to chemical composition and heat-treatment. The author, dealing with a suggestion that the ratio of feed metal to casting was too high in the case of a tank wheel and hub, gave the following figures:—*Tank wheel:* Weight of casting, 52 lbs.; weight of feeder, 26 lbs. *Tank hub:* Weight of casting, 98 lbs.; weight of feeder, 30 lbs.

MR. A. E. PEACE, commenting on strainer cores, expressed his preference for clay-bonded material. Pulls and tears, he observed, could be traced to the "dry" and not the "green" strength of synthetic sand.

MR. ROXBURGH could not confirm that trouble had arisen through using oil sand for strainer cores. Dealing with ball feeders, these were incorporated in the corebox and their positioning was not left to the craftsman.

The appreciation of the members for the privilege of hearing Mr. Roxburgh's lecture was voiced by Mr. Dunleavy and Mr. Goodwin.

A NEW SOUTH AFRICAN BRASS FOUNDRY

"The Engineer and Foundryman" (South Africa) announces the creation of a foundry at Alberton, near Johannesburg, by a new company—James Barwell (South Africa), Limited, which is associated with James Barwell, Limited, of Birmingham. The latter concern is well known as manufacturers of and exporters of plumbers' brass work. The new foundry will initially produce 15 tons per week of cored castings. A complete sand reconditioning plant has been installed, together with power-driven moulding and coremaking machines. Melting is effected by electric induction furnaces and a bank of pit-fires to serve with jobbing floor. The moulding machines are served by a conveyor, upon which the moulds are cored up and poured. The knock-out is provided with a vibrator.

Electronic Riveting.—In assembling one of the largest American all-metal bombing planes, about 10,000 aluminium rivets must be driven at points that are accessible from only one side. The explosive rivet was developed for use in such places. The explosive is contained in a small cavity in the inaccessible end of the rivet and is detonated by heat. The heat was originally transmitted through the rivet by holding against its head a hot metal tool similar to a soldering iron, but an electronic method is now available, in which radio waves are concentrated in the rivet head and generate eddy currents that produce heat. As many as twenty rivets a minute can be detonated. They are inserted ahead of time and are held in place by Scotch tape.

METALLURGICAL FACTORS OF IMPORTANCE TO THE PRACTICAL ALUMINIUM FOUNDER*

Report of Practical Experience with Aluminium Alloys

By S. A. E. WELLS

In introducing his Paper, the author first recapitulated that some material was from a Paper* entitled "The Effect of Melting Conditions on Light Alloys," presented to the last International Foundry Congress under the joint authorship of Mr. A. J. Murphy, Mr. R. J. M. Payne and himself. Amongst the subjects covered were contamination of aluminium by iron, and in this connection he detailed the following experiment:—A piece of cast iron freshly filed on all surfaces was dropped into a crucible containing some molten aluminium which had been raised to a temperature of 750 deg. C. The crucible was then removed from the furnace and the contents allowed to solidify. When cold the resultant block of metal was suitably sectioned and polished for microscopic examination. Fig. 1 shows the result.

Another form of contamination which should be mentioned is the inclusion of oxides in the molten metal. The inclusions usually arise from the oxide scum covering the metal being pushed under the surface either when making additions to the charge or during stirring. Elementary precautions will prevent this happening. Additions to the melt should only be made after the oxide scum on the surface has been pulled to one side to expose clean metal, and when stirring is contemplated the surface should be skimmed clean beforehand. It is, however, desirable to limit the amount of stirring to avoid disturbing the oxide scum unduly because the film provides a cover which arrests further oxidation and therefore cuts down metal losses.

It is much better to take steps to avoid the entry of oxides into the metal than to have to remove them subsequently. The oxides being somewhat similar in density to the metal itself, do not separate easily by reason of differences in density as is the case with some metals, and once they become entrained they are difficult to remove and one must resort to flux treatment. The latter, however, is not always completely effective. There are, of course, other reasons for the appearance of oxide inclusions in castings, such as turbulent pouring, etc., but one should at least do what one could to ensure starting off with reasonably clean metal.

Grain Refining

The author next covered the effect of the temperature attained by the molten metal during melting and then grain refining, and included some matter relative to the production of material for forgings, etc. In such cases an intrinsically fine-uniform grain size in the ingot or billet is of primary importance, and unless this is obtained consistent progress in the mechanical working operations cannot be expected. Material possessing a coarse non-uniform grain size

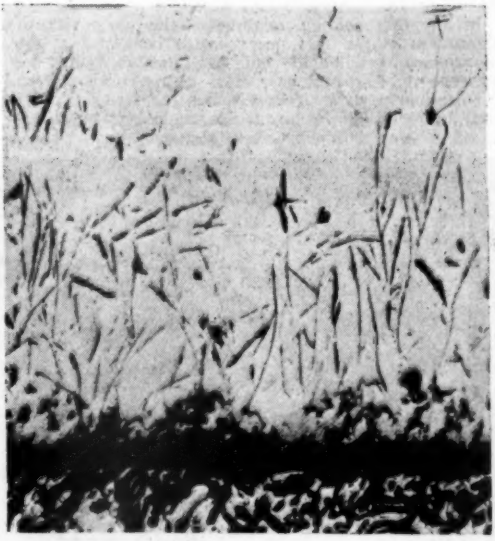

FIG. 1.—ILLUSTRATING THE AFFINITY OF ALUMINIUM FOR IRON. THE NEEDLES OF THE IRON-ALUMINIUM COMPONENT FORMED IN THE REGION OF THE INTERFACE CAN BE CLEARLY SEEN. (x 150).

appears to be inherently weak at the working temperature and is liable to crack under the shock of hammer blows.

In respect of large forgings fabricated from ingots or billets, there is another reason which makes a fine grain size in the original cast ingot especially desirable. The production of large forgings is usually accomplished under conditions of some limitation.

D

* Paper read before the London and Lancashire Branches of the Institute of British Foundrymen.

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There is frequently a restriction on the size of the ingot that can be used, and thus the reduction of section that can be achieved under the hammer or press is insufficient to produce optimum mechanical properties. In these circumstances the finer the grain size of the original ingot the better are the mechanical characteristics, notably the ultimate stress and elongation in the tensile test, of the material in the finished product.

There is an important reason why 800 deg. C. is adopted as the pouring temperature for the grain size test. It was considered that unless the grain refiner would exert its full effect on metal that had reached a temperature of 800 deg. C., it could not be expected to take care of the extremes likely to be encountered in practice. Experience has established that this reasoning was correct.

In any investigation relating to the grain size of aluminium alloys it is necessary to be aware of the spurious effects which can be introduced by the presence of dissolved gas. The escape of gas from the cooling metal as it approaches the freezing point and during solidification causes agitation, which in itself produces a certain small degree of grain refinement. It is therefore desirable to eliminate this factor, by ensuring that the molten metal is substantially free from dissolved gas when testing grain size, and the use of a suitable degassing flux is recommended.

Generally speaking, the amount of the grain refining element to be added is quite small; in fact, less than 0.2 per cent. is required. When using niobium or titanium, the grain refiner is conveniently added in the form of a hardener or key alloy, the bulk of which consists of aluminium.

It is desirable to use a moderately dilute hardener containing about 5 per cent. of the refining element, as this makes for easier working and avoids having to raise the alloy proper to the high temperature which would be necessary to dissolve a richer hardener. When alloys sensitive to iron "pick-up" are to be grain-refined it is self-evident that the iron content of the hardener must be controlled and kept as low as possible, in order that when an addition of the grain refiner is made, the iron is not increased beyond an amount that can be tolerated.

Influence of Titanium on Grain Refining

Turning to consideration of titanium, this element is capable of grain refining a similar range of alloys

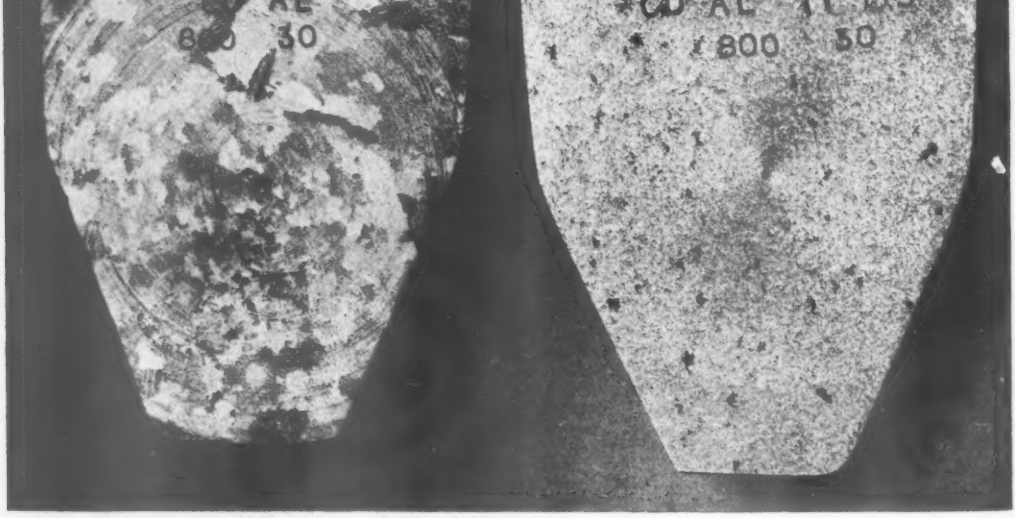


FIG. 2.— 4.5 PER CENT. COPPER ALUMINIUM ALLOY. UNREFINED ON LEFT; REFINED WITH 0.18 PER CENT. TI ON RIGHT.

to those in which niobium has been found to be effective. The amount of titanium necessary to ensure a consistent grain size of a fine order appears to be about 0.15 per cent.

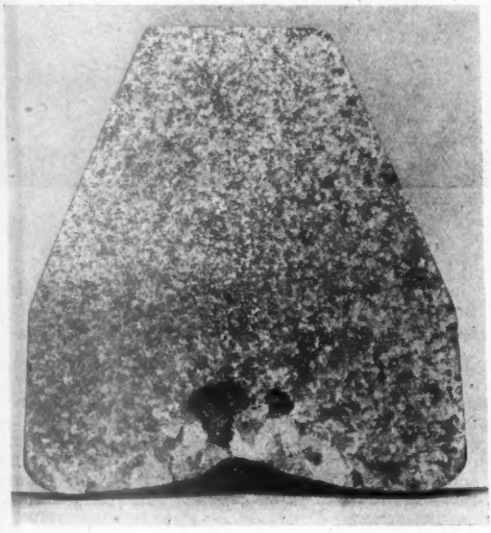
This was confirmed as the result of examining an inconsistency in behaviour of a straight 4.5 per cent. copper-aluminium alloy grain refined by means of 0.10 per cent. titanium, in which the refining action did not seem to be reliable. As a good deal of the material concerned had been subjected to several remeltings without flux, it was thought that possibly a loss of titanium may have resulted from repeated remelting.

Some of the ingot was taken and remelted five times, reaching a temperature of 800 deg. C. at each remelting. The titanium was then estimated in samples from the first, third and fifth remelt, and compared with the titanium content in the original ingot. The chemical analysis figures were:—Original ingot, 0.095 per cent. Ti; 1st remelt, 0.097 per cent. Ti; 3rd remelt, 0.098 per cent. Ti; 5th remelt, 0.094 per cent. Ti; and these led to the conclusion that no loss of titanium is to be anticipated on repeated remelting.

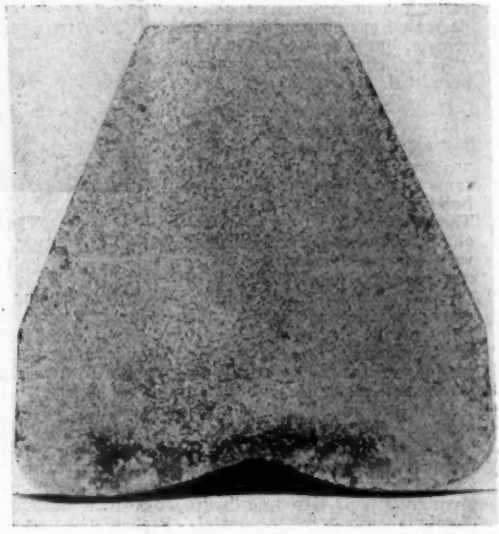
The trouble with this material was eventually eliminated by adding a further 0.05 per cent. titanium, thus indicating that the initial titanium content was insufficient, as is shown in Fig. 2.

It is inadvisable to add excess of the grain refiner over the amount necessary to obtain optimum effects, because there is a tendency for loss of elongation with increasing quantity of the refiner, for example over 0.3 per cent. of either niobium or titanium is detrimental. Of other methods of introducing the grain refining element into aluminium alloys, perhaps the best known is that of treatment with special fluxes. In this case the flux carries the refining element in the form of a salt. When the flux is plunged into the molten alloy it is decomposed, with the result that the grain refiner is released and enters into the metal. Boron, which has been mentioned as one of the outstanding grain refiners, is usually added in this way with good effect.

The theoretical side of the question of grain refinement is very involved, and needs a good deal more work to elucidate the mechanism before an entirely satisfactory explanation is likely to be forthcoming. An interesting theory is that the grain refining constituent, which invariably has a higher melting point than the basic alloy, is thrown out of solution as a shower of sub-microscopic particles as cooling proceeds; these particles then act as centres of crystallisation over and above those normally provided by the solidification of the alloy itself. On the number of nuclei thus available depends the final grain size of the metal; broadly



TOP OF MELT.



BOTTOM OF MELT.

FIGS. 3 AND 4.—ILLUSTRATING THE EFFECT OF SEGREGATION OF THE GRAIN REFINER ON GRAIN SIZE, IN A MELT HELD IN THE TRANQUIL STATE FOR 1 HOUR AT 700 DEG. C. THE BOTTOM PORTION OF THE MELT IS ENRICHED AT THE EXPENSE OF THE TOP PORTION, WITH THE RESULT THAT THE TOP AND BOTTOM EXHIBIT DIFFERENT GRAIN SIZES. REFINER: 0.10 PER CENT. NIOBIUM.

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speaking, the greater the number within limits the smaller will be the grain size.

Although this may not be the complete story, the fact that segregation of the grain refining constituent occurs when the metal is held for a period in the tranquil state at a low temperature, certainly indicates that something of the sort does happen.

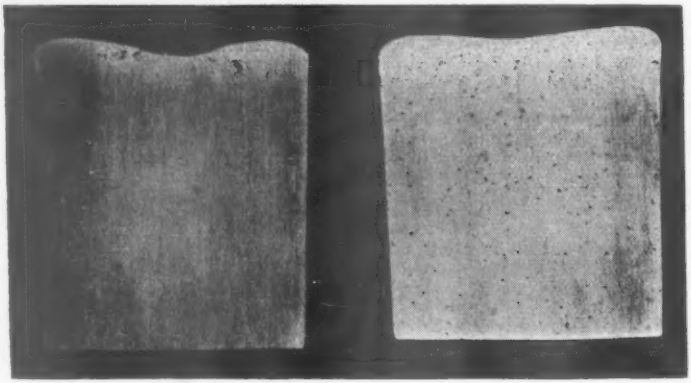
The remedy for ensuring freedom from this type of segregation is to give particular attention to stirring immediately before transferring the molten metal from the melting furnace or pouring castings from a crucible. This is shown in Figs. 3 and 4. It can be seen from the foregoing observations on grain refinement that, when using an aluminium alloy which is intrinsically fine-grained, on account of the presence of a special element, the founder is relieved of one serious restriction in melting conditions, namely, the necessity for maintaining the temperature of the melt below the critical level above which grain coarsening occurs. This is not to say that the other advantages of low melting temperatures, such as decreased gas absorption, do not remain, but a greater latitude in working conditions is certainly permitted.

Gases—Occurrence, Causes and Removal

Founders of aluminium alloys are familiar with the troublesome defect known as "pinholing" or speckling in castings. These "pinholes" or "speckles" consist of small cavities which vary in shape according to the crystallisation characteristics of the alloy, and become visible when the casting is machined; they are usually disseminated through the body of the casting and therefore persist irrespective of the amount of metal removed in machining. Sand castings are prone to exhibit the trouble to a marked extent, but die-castings seldom show the defect.

Dissolved gas in the metal is the generally accepted cause of the "pinholes," and it is mainly attributed to the absorption of hydrogen by the melt. In the majority of cases water vapour is the source of the gas. The water vapour is decomposed by the molten aluminium and sets free hydrogen, which is immediately absorbed by the metal. Particularly harmful is the presence of water vapour in the furnace atmosphere; this can arise from the air supplied for combustion, from the fuel itself and not infrequently from residual moisture in the furnace lining or crucible. It is an established fact that newly lined furnaces often yield gassed metal for a while, even when dried out and heated to redness before use. Damp coke in pit fire furnaces is a very potent source of water vapour and emphasises the importance of storing the fuel under cover. In fact, to ensure freedom from gas "pick-up" from the coke, it should be completely dried before use.

Corroded metal is another means by which gassing of a melt can take place; in this case the salts formed as products of corrosion produce water vapour when the metal is heated; the danger can, of course, be minimised by removing the corrosion by such means as shot blasting, scratch brushing, etc., before melting. The offending gas can also be introduced into a melt by the metals constituting the charge. In this event the metals themselves are gassy and carry the hydrogen into the melt to which they are added. Other gases in the furnace atmosphere do not readily diffuse into aluminium and its alloys at the usual melting temperatures, and little trouble is likely to arise from these gases under ordinary circumstances.



TREATED. UNTREATED.

FIG. 5

Elimination of Pinholes

The question of eliminating "pinholes" by the removal of the gas from the melt has received attention for some years, and methods have been evolved by several investigators all of which are capable of effecting improvement. Objections have been raised to the employment of most of the methods on the ground that there is either an uneconomic time factor involved in the process or somewhat elaborate apparatus is necessary. In more recent times the employment of fluxes has been developed with pronounced success, and the simplicity of application of these flux treatments has resulted in the older methods being largely superseded.

In some cases the flux is thrown on to the surface

of the molten metal and stirred in, the stirring being repeated several times during cooling, while with other fluxes a special plunger is used to carry the flux to the bottom of the crucible and hold it there until action ceases. Most of these fluxes consist of mixtures of two or more chlorides and fluorides of the metals sodium, potassium and lithium. It is, of course, essential that these salts mixtures are perfectly dry when used so as to exclude the possibility of the presence of water vapour, whose damaging effect was examined earlier. A typical example of these fluxes is a mixture of two parts by weight of sodium chloride and one part by weight of sodium fluoride, the commercial quality of the salt being used in each case.

The procedure in using the flux is to raise the metal temperature to 750 deg. C. and then an amount of flux equal to 0.5 per cent. of the weight of metal is spread evenly on the top of the metal and the flux pushed under the surface by means of an iron skimmer, until the flux rising to the top again is seen to be fused. The metal is then stirred several times, after which the products of the treatment are skimmed off, and the metal cooled to casting temperature. If for any reason it is desired to measure the temperature of the metal while the surface is covered with flux, a steel-sheathed pyrometer should be used or the readings may be unreliable.

The effectiveness of the method described is illustrated in Fig. 5, which shows sections of 3 in. dia. blocks cast from the same melt, before and after treatment. The metal is Ceralumin "B" to specification D.T.D. 287. It is not advocated that degassing treatment should be employed as a matter of routine, but only when it appears to be necessary. Three reasons can be cited for exercising discretion in this direction: (1) Crucibles made of siliceous materials are attacked to some extent by the fluxes, particularly those containing fluorides, which incidentally are the most effective degassers; (2) removal of gas from the metal increases shrinkage, and this necessitates greater attention to moulding technique to ensure adequate feeding of the castings; and (3) changes in chemical composition can occur as the result of flux treatment.

Fluxes which are manipulated by plunging into the melt are those that function as the result of the evolution of an active gas such as chlorine.

Change in Composition

In general, one does not have to contend with volatilisation in alloys of aluminium; there remains, how-

TABLE I.—*Effect of Repeated Melting*—"*Alpax Gamma*."

	Magnesium per cent. by analysis.	"As Cast." Brinell hardness, 10/1000/15.	Heat-treated. Brinell hardness, 10/1000/15.	0.1 Per cent. Proof stress. Tons per sq. inch.	Ultimate stress. Tons per sq. inch.	Elongation. Per cent. on 2 inches.
Repeated fluxing—						
1st fluxing	0.33	60.5	120	— 16.50	17.88 19.00	1 1
2nd fluxing	0.20	60.5	112	— 16.40	18.60 18.80	1.5 1
3rd fluxing	0.19	58.3	106	— 15.08	18.00 18.48	2 2
4th fluxing	0.10	53.8	104	— 13.48	17.40 17.84	2 3
Repeated remelting without flux.						
Original melting ..	0.42	59.8	120	— 18.56	18.24 18.56	0.5 0.5
1st remelt	0.41	55.8	125.5	— —	17.76 18.28	Nil 0.5
2nd remelt	0.38	60.5	125	— —	17.44 17.40	0.5 0.5
3rd remelt	0.35	55.1	126	— —	16.90 17.00	1 0.5

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ever, the possibility of the composition of the charge being altered by the loss of one or more of the constituents during melting, and the investigations now to be described briefly show how a change of composition can occur in certain aluminium alloys.

The object of the experiments was to ascertain if any loss of magnesium occurred either when flux degasification treatment was applied to a melt or when the melt was subjected to ordinary melting only without fluxing. Alloys Ceralumin "B" (D.T.D. 287) and "Alpax Gamma" (D.T.D. 245), with nominal magnesium contents of 0.1 per cent. and 0.4 per cent. respectively, were chosen for the investigations, and the effect of repeated application of flux and the influence of remelting several times without flux were examined.

The fluxing experiments were carried out on single 20-lb. melts, which were treated four times with a dry flux mixture of 2 parts sodium chloride and 1 part sodium fluoride, using 2 per cent. by weight of the salts mixture on each occasion. At each stage the temperature of the metal was raised to 750 deg. C. for fluxing, and after fluxing cooled to 700 deg. C. to enable two standard test-bars to be poured. The heads of the test-bars were cut off and returned to the crucible to maintain an approximately constant area of surface of metal exposed to the action of the flux. The quantity of the metal treated therefore only varied by the small amount required for the test-bars.

The remelting experiments without flux were also made on single 20-lb. melts. The procedure was to raise the temperature of the melt to 750 deg. C., cool to 700 deg. C., and cast two standard test-bars and then pour off the remainder into ingot moulds, the ingots and the heads cut from the test-bars being remelted at each stage. Three stages of melting were carried out in all. Samples consisting of turnings from the complete cross-section at the top of a test-bar representative of each stage of the experiments were taken for determination of the magnesium content in both the fluxed and non-fluxed series. The normal heat-treatment for the respective alloys was applied to the test-bars before making mechanical tests. Brinell hardness determinations were also made on pieces in the "as cast" condition, as it was thought that some difference might be observed even at this stage if any marked loss of magnesium had occurred.

Loss of Magnesium

Considering the results of the experiments on Ceralumin "B" it is found that a serious loss of magnesium can occur from a repetition of the fluxing treatment, resulting in a softening of the alloy, the effect being marked on all the mechanical properties examined. The series of tests on the repeated remelting of the alloy in the absence of the flux show that no loss of magnesium need be anticipated. Tensile tests were not carried out in this series of experiments as it was obvious from the chemical analysis and hardness tests that no loss of magnesium had occurred.

Turning to the experiments on "Alpax Gamma," losses of magnesium are shown by Table I to be substantial in the metal subjected to repeated flux treatment, and it will be noticed that 75 per cent. of the original addition has been lost after the four treatments. A small loss has occurred on repeated remelting without flux. The test figures demonstrate that decreases in the magnesium content as the result of flux treatments of the melt materially influence the proof stress, ultimate stress, elongation and Brinell hardness. In the case of remelting without flux, where the loss of magnesium is much less, there is a tendency for the ultimate stress to decrease at the same time as the magnesium.

An interesting observation is that in spite of removal of magnesium all the test-pieces gave values of tensile strength in excess of the 15.5 tons per sq. in. required by specification D.T.D. 245. If for any reason a melt of aluminium alloy of the types examined is treated more than once, or at the most twice, with a flux of the kind described, an addition of magnesium should be made to compensate for the loss due to the action of the flux. The same consideration has to be borne in mind if remelted runners and risers that have previously received flux treatment constitute a large proportion of the charge, a condition which is likely to arise when the metal ratio on a job is high, that is when the weight of the untrimmed casting is large in relation to the finished casting.

Ceralumin "B" does not show a loss of magnesium when remelting in the absence of the flux in the same manner as "Alpax Gamma"; this is probably due to the much lower initial magnesium content of the material making it less prone to selective oxidation. Although the experiments described deal with the effects of one flux only, the case is not exceptional, and in searching for a reliable degassing flux, different mixtures have been tried, including many proprietary fluxes, but so far all have had the same effect on the magnesium content of the alloy or have failed to satisfy as degasers.

In conclusion, the author expressed his thanks to the directors of J. Stone & Company, Limited, for permission to use the results of the investigations reported in this Paper, and also to his colleague, Mr. J. P. Ellis, for his assistance in the preparation of the lantern slides.

(*To be continued.*)

Dominion Steel & Coal Corporation, Limited, Sydney, N.S., has completed and put into production a new 75,000-ton per annum open-hearth furnace.

American industrial facilities will require a total of 904,800 short tons of cast iron for construction and machinery and equipment for 1943, it is estimated by the W.P.B. This estimate includes all new construction, major allocations, additions and facilities. The relatively high volume reflects the extent to which cast iron is being substituted where possible for steel. Of the total, 770,900 short tons will be required for machinery and equipment, while the remaining 133,900 short tons will be consumed in construction.

THE YOUTH IN THE FOUNDRY INDUSTRY*

By W. Holland

(*Slightly Abridged*)

Many of the leading industrialists state that children should be educated to some particular sphere in technology whilst at school, and further, that they should by this education be able to decide which class of industry both suits and attracts them. Very little appears to have been done towards this end, other than in the form of additional education after leaving school. It does seem, however, that the boy of to-day leaves school with some yearning to produce something. His mind is receptive to ideas and ideals. What boy does not feel attracted towards the aircraft industries?

Now has the foundryman anything to offer in exchange for the glamour of the aircraft and mechanical industries? Is it not a fact that very few boys would voluntarily enter the foundry were there any opportunities in any other trade? Thus one of the oldest industries is doomed to deterioration owing to the lack of education and attraction to the boy, it being a well-known fact that no industry can be secure without being reinforced by new blood.

Through familiarity most foundrymen take for granted the constructive ability which goes into the making of some intricate casting from what was once a lump of pig-iron, yet the youth of his own volition is expected to appreciate this.

One of the roots of the trouble is that foundry work is made to appear too easily learned, and that it is only necessary to throw sand into a moulding box, lift off the pattern, place two parts together and fill with metal. At least this is what the average semi-skilled repetition foundry workers will instil into youth. Why not a little more than this, some understanding of the reasons for moulding in a certain way, making every casting an object lesson?

Then there is the tone of the foundry. If a boy is of no use anywhere else, it is usual to put him in the foundry. The foundryman, therefore, condemns his own industry by informing the world that intelligence is not necessary. Build up this tone by more discrimination in choosing the moulders of the future. It is admitted that there is room for many grades of intelligence in the foundry, but not as moulders.

The aim of the executive should be to grade youths according to their ability, the lower grades doing the labouring, with the shutting of the doors to all those that have not the intelligence to grasp the subject of mould-making without having to drive it home with a sledge hammer. Another factor is the "slogging." Hard graft will never attract the youth. When he knows that the first years of his semi-training must be spent in fetching sand, moving box weights, mixing sand and knocking off castings from runners, can it be wondered that his keenness disappears? Still another cause is that he is given no understanding as to his prospects—his training is never considered and he is "dumped" anywhere that a boy can be usefully employed. Then there is the dust and heat, to say nothing of the cold and draft that are found in almost every foundry.

It is not suggested that a vote of censure be taken on the foundry, but rather that the whole conditions be examined humanly and psychologically, so that the industry be saved from its own suicide by re-moulding into a new framework. Commence this process of re-moulding by building up the tone of the foundry with more discrimination in the choice of the youth.

The Ideal Foundry

The ideal foundry would be to set up a bay equipped with moulding machines, benches and space for floor moulding, in the charge of a good technically trained man, who would make it his job to pass all promising youths through this. He would also interest the boy by making a study of every job, the reason for coring, moulding without cores, venting and feeding, and finally holding a *post-mortem* on all scrap castings to prevent the constant repetition one usually sees in a foundry of some particular type of scrap.

Without going deeply into the question of costing, it can easily be realised that even in this bay, work can be quoted for and made at a price which will repay any outlay. Its usefulness can also be seen in the way it can be adopted in the making of oddments, samples for repetition jobs and trials for the pattern-shop. Boys leaving this bay would have a sense of responsibility instilled into them that in itself would add interest and "spice."

Apart from this, give a boy a more progressive training, attract his interest by varying the job at least every six months. Pass him into the core shop in order to give him some idea of the value of cores. Lay out a table of movements for each boy and let him know what his prospects are. It is detrimental to his welfare to let him think he is going to grade into some particular job when there is no intention of letting him land.

The question of conditions under which the foundry labours is of great consequence. The constant change during the winter of extreme cold before and the excessive heat during casting time, together with the steam and fumes, demands that something be done to improve conditions. It is not suggested that there should be a glazed brick wall and floors swept every day, but why should the modern machine shop have air-conditioning before the foundry, where every condition is detrimental to consistent output as well as to make the youth look around for a change of employment?

The tendency of the foundry is to mechanise that part of the job which can readily be done by hand, the parts that would definitely ease the muscles generally being man-handled. Typical of this is the jolt squeeze, which performs the mechanical ramming, but gives no assistance to the transportation of sand or the lifting off of the box.

* A prize-winning entry to a competition organised by the East Midlands Branch of the Institute of British Foundrymen.

Youth in the Foundry

Most industrialists stress the point of technically training all youths. This is a question which requires careful consideration.

By all means give every opportunity to the youth who shows signs of ability and wanting to get on, but when it is intended that he shall be kept on semi-skilled or repetition work, it is most demoralising to him and to the job, to encourage technical training and then gain no advantage from it.

The whole aim of this Paper has been to create a more attractive atmosphere to the youth in order to induce him to take up foundry work as a career, but so much antipathy has been shown against the foundry that it will require much to neutralise it.

The solution seems to be an entirely new complexion on foundry employment, to be offered through the headmasters, and if jobs are made sufficiently attractive, there is no doubt whatever as to the satisfactory future of the foundry industry.

DISCUSSION

MR. A. B. BILL said he noticed that Mr. Holland insisted that in the aircraft industry, boys were given an excellent practical training, and he suggested that something of the same type should be given to boys entering the foundry industry. This was done by some foundry concerns. Mr. Holland remarked that boys were taken into the foundry and were given no promise as to prospects, but surely this applied to most trades including the aircraft industry. In the foundry the percentage of labour which did progressive and interesting work was certainly as great as the aircraft factories. Possibly in the latter there was a greater scope for the leading technicians, yet he doubted whether, generally, their job was of any more interest than that of a man making a mould.

MR. HOLLAND, in reply, pointed out that the Paper did not state that aircraft industries gave excellent practical training, but it was stressed that the glamour, not the trade, attracted the boys, and as all glamour had gone from the foundry, some other allurements must be sought. It could not be reasoned that because the aircraft industry did not give a reasonable assurance to its youth regarding future possibilities, the foundry should not. It did seem, however, that the initiative for ideas lay with the aircraft industry and the youth sensed this, but this was where the foundry must reassert itself by striking out on its own initiative. By passing through the suggested training bay, the boys would be graded. The executive could not tell where the interests of the boy were, unless he had been tried in all spheres.

Regarding the further remarks of dirt in the foundry, it was not meant that the floor dirt should be cleaned up, but that the dirt and fumes in the air should be removed. Coal dust was not used extensively enough to create the suggested conditions.

With regard to technical training, its primary intention was to train youths for executive positions and the youth who took honours in various examinations expected that he would have some recognition shown to him for his efforts, and when this was not forthcoming he felt dissatisfied with himself and his job.

MR. H. BUNTING said a few years ago if a boy was asked what he wanted to do when he left school, he would say he wanted to be an engine driver, but now he wanted to fly an aeroplane. The foundry industry would do better when the management realised that it was their job to run the foundry and also when the boy at school was not taught that it was preferable to have a white collar job. The foundry was dirty and there was nothing easy about it. A remarkable thing, however, was the ripe old age moulders attained.

Effect of Inefficient Training

MR. HOLLAND, in reply, said, due to inefficient training, the foundryman invariably had to rely on the patternmaker for his interpretation of the drawing. He was probably not able to decide whether it was right or wrong and left the decision to the patternmaker. It therefore appeared that the patternmaker, owing to his superior training, ultimately took command, and also the fact that he was in contact with all the varied troubles in connection with the running, feeding and coreing of the various jobs, eminently suited him for the position. If he also had some practical training in the foundry he was certainly an asset.

Mr. Bunting also referred to a boy's ambition to fly an aeroplane. This did stress the fact that the boy's ideas were subordinated to his ideals. His interest in the foundry industry should be attracted during his last term at school by slides and films, so that the romance of the foundry was instilled into him. A fully mechanised foundry certainly speeded up production, lightened labour and made the foundry industry a good one for any boy to enter.

MR. W. H. SMITH regretted that when a Paper of this type was read there were not more representatives of the administration present. The executives could appreciate the soundness of Mr. Holland's arguments, and could keep on repeating them, but unless the administration co-operated they were still ploughing a long, lonely furrow.

MR. J. ROXBURGH said the one criticism he had to offer was that the comparison made between a foundry and the aircraft industry or machine shops was quite unfair. In a foundry, conditions were entirely different, as various materials were used which gave rise to dirt, dust and steam. Moulding was recognised as one of the "dirty" trades, but, in many ways, improvements in conditions could be made. For instance, improved ventilation and the use of mechanical aids to reduce manual labour should receive attention. Even in highly mechanised foundries, working conditions were arduous and not all that could be desired. The question of apprentice training was another controversial matter. Mr. Holland referred to semi-skilled operatives and, of course, with this class of operative, apprenticeship, in the strict sense of the word, was not applicable. With skilled crafts, however, apprenticeship was essential, whereby a youth should primarily be trained to become a skilled crafts-

man. In addition to his actual employment, he should be regarded as a student and should be given facilities to acquire technical education, as a result of which he would know how to do a job and why he does it in that particular way.

The principal idea behind an apprenticeship was to train a youth to become a skilled craftsman and technical education was a help to this end. His subsequent career depended to a large extent on his ability, etc., his ambitions and opportunity.

Most people who work in a foundry were apt to criticise conditions and training schemes, but, although foundry work ranked high amongst skilled trades, foundrymen must see to it that their industry was recognised as such by those outside as well as those inside.

Foundries v. Aircraft Industries

In reply to Mr. Roxburgh, MR. HOLLAND agreed that a Paper of this description must of necessity be very general in character owing to the fact that it is intended to cover all classes of foundries, whether ferrous or non-ferrous.

It did seem that the reference to aircraft industries raised some opposition. It was definitely true that boys preferred the aircraft industry to the foundry, and the fact that the foundry was dirty did not ease the situation. If boys were to enter the foundry, something must be done regarding this counter attraction, by improving the ventilation, having efficient knock-out arrangements, mechanical means of handling sand to prevent the spilled sand which usually prevails where barrows are the means of transport, and mechanical means of handling the metal to prevent the constant splashes of molten metal over the foundry floor.

Mr. Roxburgh's reference to semi-skilled workers not having an apprenticeship, in the general sense of the word, is no doubt correct. In the early days of the youth, will the foundry be able to decide without any training, who are to be moulders and who are to do the semi-skilled work? It had yet to be proved that semi-skilled moulding did not require any skill. It must be admitted that a large percentage of these semi-skilled men did not use skill, by the fact that it was not unusual for this type of work to have a production figure of only 80 per cent. good castings, against 95 per cent. from skilled moulders.

It was necessary for the skilled moulder to know the reason why a job is made in a certain way. The semi-skilled man need not worry about this, but he did need to worry about ramming densities, speed of pouring and innumerable other points. Invariably the youth was not shown these pitfalls, but had to learn in the hard school of experience where every scrap casting was to him unpaid labour.

The foundry should make more use of the youth's training, disregarding into which class of moulding he will eventually work, as the psychological effect of a career which was too easily learned was not conducive to applications for entry into that trade.

(Concluded in next column.)

PRODUCTION OF SMALL STEEL CASTINGS

At a meeting of the Burnley Section of the Institute of British Foundrymen, Mr. W. M. Lord, B.Sc., director, Sandholme Iron Company, described the production of small steel castings, giving special attention to the baby Bessemer process. He described in detail the standard system of operating the converter, using at the beginning of the blow 60:40 hematite-steel scrap, and gradually diminishing the pig until towards the end of the day only 20 per cent. is being used. Using 12½ per cent.-Si ferro-silicon, the silicon is controlled at 1.7 for the first blow and 1.2 per cent. in the later stages. Before transferring the cupola metal to the ladle, it is desulphurised with soda ash and powdered limestone.

After blowing out the carbon, silicon and manganese, the author's practice is to shut off the blast, burn the vessel to the horizontal position, and add red hot pig-iron, 80 per cent.-Mn ferro-manganese, and 45 per cent.-Si ferro-silicon. Bottom pouring ladles are used, and final deoxidation is ensured by small quantities of aluminium.

Green sand moulding is widely used. The new sand deposits opened up since the war have given good results either by themselves or as a synthetic base used in conjunction with bentonite. After referring to the work done on the positioning and size of feeding heads by Duma and Brinson and by Taylor and Rominski (the Williams' process) in America, the author confidently anticipated the future saving of steel of worth while dimensions. Oil-sand moulds are receiving increasing attention as affording a reliable and easy method of taking care of the high contraction property of steel castings, whilst at the same time providing a hard yet permeable mould face.

For the removal of feeding heads, the author favours the oxy-propane system. Finally, the author shortly dealt with the heat-treatment of steel castings.

The Chicago Museum of Science and Industry possesses as an exhibit a model modern foundry, which is visited annually by a million people. Since Pearl Harbour it has become a sub-contractor for the supply of munitions, whilst still retaining its educational function, as it is utilised in connection with the local naval training centre.

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Mr. Roxburgh further stated that people who worked in the foundry were apt to criticise conditions and training schemes. Who, but the man who works in the midst of these conditions was in a position to criticise? As long as this criticism was along constructive lines it would no doubt be agreed that it was what was wanted, and was an opportunity of letting the outsider know that the foundry was aware of its own shortcomings and was grappling with the subject.

SIGNIFICANCE OF PHYSICAL TESTS

HARDNESS VERSUS DUCTILITY

The significance of physical tests in metallurgy is discussed by MR. J. O. ALMEN, of the Research Laboratories, General Motors Corporation, Detroit, in a Paper entitled "Improving Fatigue Strength of Machine Parts," recently presented before the American Gear Manufacturers' Association and reported in the "Iron Age. In his review of the subject, the author points out that several kinds of impact tests are still being used and impact specifications appear in many drawings, but no one can explain and substantiate the significance of the test in terms of the service strength of machine parts. Elongation and reduction of area are carefully measured and are prominent in all specifications, but their meaning in terms of serviceability of machine parts is not known. It is stated that "brittleness" must be avoided, but no matter how brittleness is defined, it does not explain why this property is necessarily more harmful than ductility. Most machine parts that are plastically deformed are just as surely failed as if they were broken. It is believed that machine parts generally must possess relatively high ductility and they must therefore be heat-treated to develop this property. However, when severe dynamic loads are applied, ductility is forgotten and high hardness certainly well within the range of "brittleness" is specified. Strong fatigue resistant gear teeth are file hard. Wrist pins, ball bearings, roller bearings, shafts and cams are hard and they are strong and fatigue resistant because they are hard.

A gear tooth is just as surely a spring as the coil that actuates a valve. Why, then, must the one be hard and "brittle" and the other be relatively soft and "ductile"? Why cannot stronger, hardened materials be used? The answer may lie in the concept of brittleness. "Brittleness" from the hardness when hardness is obtained by nitriding is not feared. Nitrided surfaces are not notch sensitive because they are stressed in compression. Notch sensitivity is probably the inability of a non-ductile material to yield locally and thus reduce tension stresses in local highly stressed regions, such as notches and scratches. The amount of ductility that is required to overcome "brittleness" depends upon the amount of yield that is necessary to reduce local tension stresses. If the surface is sufficiently pre-stressed in compression, local yielding is not required and therefore non-ductile materials will not be "brittle." As understanding of "brittleness" is improved the use of steels at higher hardness will be expanded.

Laboratory Tests

Laboratory hardenability tests are now coming into general use. This test has much merit provided its meaning is understood and that arbitrary hardenability specifications are not applied without considering the requirements of each particular part. Through hardenability (approximately uniform hardness through the section) can be very important for parts that are stressed in tension, but it is difficult to see why through hardness is necessary in parts that are loaded in bending or in torsion, because in such members the stress decreases somewhat linearly with depth reaching zero at the neutral axis. For this kind of loading it would seem to be more important to develop heat-treatments that give a type of internal stress negative to the applied tension load, as by that means the dynamic load-carrying capacity is greatly increased.

The standard laboratory tensile test is, of course, incapable of indicating the useful bending or torsion strength of pre-stressed specimens, particularly when the pre-stressing is deep. For such specimens the tensile test cannot even distinguish between harmful and beneficial pre-stressing. Both would probably show decreased tensile strength, whereas under dynamic bending or torsion loads one would show greatly decreased fatigue strength and the other greatly increased fatigue strength.

Life of Machine Parts

Fatigue data are mortality data, and it is just as absurd to expect that reliable actuarial tables can be constructed from mortality data on a half-dozen individuals as to expect that reliable comparisons can be made from fatigue tests on a half-dozen machine parts. Referring to the relative life span for various machine parts, the author says that for automobile rear axle gears, for example, the life span of the most durable unit is about four times the life span of the poorest unit, but for automobile transmission gears the life ratio from the best to the poorest is about 15:1.

The percentage variation in life of machine parts will also change as the test load or load range is changed. When tests are conducted at high load or high load range to produce fatigue failure after relatively few stress cycles, the percentage variation from the best to the poorest will be less than if the test is conducted at a lower load to produce fatigue failure after a relatively large number of stress cycles. In the class of light machines where weight must be conserved, it will probably never be possible to design mechanisms to withstand all the abuses that are encountered in service. If an airplane engine, for example, should be so sturdily designed that the shortest lived of each of its numerous parts would be failure proof under all the abusive conditions that may be experienced in service, the engine would be so heavy as to be impractical.

In practical fatigue testing of machine parts, it should be obvious that comparisons of material, design or processes cannot be made unless the tests are run to failure and the comparisons are made on the number of stress cycles each will endure. This is true whether or not the part being tested is required to withstand, in service, a very large number of stress reversals at maximum load, such as a crankshaft or a relatively small number of stress reversals at maximum load, such as chassis springs. Since all representative tests are made at loads that result in failure by fatigue, interest lies not in the fatigue endurance limit where for steel, under most test conditions, life is infinite, but in that portion of the fatigue curve to the left of the "knee" where life is infinite.

INSTITUTE OF BRITISH FOUNDRYMEN

NEW MEMBERS

At a meeting of the Council of the Institute of British Foundrymen, held at the Queens Hotel, Birmingham, on October 16, 1943, the following were elected to the various grades of membership.

As Subscribing Firm Members

Butler-Jones (Nameplates), Limited, Kangley Bridge Road, Lower Sydenham, non-ferrous founders, engravers, etc, (representative, W. R. Butler-Jones); Lord, E. S., Limited, Bury Road, Rochdale, core compound manufacturers (representative, E. S. Lord).

As Members

T. Arnett, foundry manager, Crofts Engineering, Limited; H. H. Aston, works manager, John Harper & Company, Willenhall; T. W. Bache, director and manager, G. Salter & Company, Limited, Birmingham; G. T. Callis, B.Sc., metallurgist, J. Stone & Company, Limited, London; T. P. Cameron, works manager, Cameron & Roberton, Kirkintilloch; A.G.F. Cusworth, metallurgist, Sheepbridge Stokes, Chesterfield; J. S. Daniels, director, J. H. & J. Daniels, Limited, Gloucestershire; E. C. Devonish, director, Devonish & Williams, Limited, London; S. Dransfield, works manager, Butler-Jones (Nameplates), Limited, London; R. C. Dyer, works chemist, H. Edie & Company, London; L. Elliott, foundry manager, Anti-Attrition Metal Company, London; H. Goodwin, managing director, Hornby & Goodwyn, Limited, Scunthorpe; E. H. Fieke, technical representative, Coneygre Foundry Company, Birmingham; M. M. Hallett, M.Sc., chief chemist and metallurgist, Sheepbridge Stokes, Chesterfield; H. G. S. Havard, B.Sc., metallurgist, Newman Industries, Bristol; W. S. Hodges, mechanical engineer, M. H. Hodges & Sons, Exeter; R. F. Horton, metallurgist, Gabriel & Company, Limited, Wednesbury; T. Hoskison, blast furnace manager, Round Oak Steel Works; J. Hunter, chief designer (Foundry Equipment Dept.), Wallwork Gears, London; A. E. Ireland, engineer, British Moulding Machine Company, Limited, London; H. A. Larred, works manager, G. R. Turner, Langley Mill; A. Linley, B.Met., chief metallurgist, Darwins, Limited, Sheffield; H. J. M. Conacher, foundry works manager, Alex. Shanks & Son, Arbroath; J. Mitchell, production manager (Tank Eng.), Rolls-Royce, Limited; J. McDonnell, B.Sc., engineer, Morgan Crucible Company, London; D. C. Palmer, general manager, Thos. Turton & Sons, Sheffield; G. W. Potts, foreman engineer, Beatson & Company; K. Strauss, D.Ing., F.I.C., chief chemist, Foundry Services, Birmingham; M. W. Walters, foundry manager, Glacier Metal Company, Scotland; R. A. Weedon, technical representative (Aluminium Dept.), Enfield Rolling Mills, London; S. A. E. Wells, metallurgist, J. Stone & Company, Limited, London; K. G. Williams, sales manager, A. Ellison, Limited, Birmingham; E. T. Ball, foundry technical assistant, Northern Aluminium Company, Cardiff; H. R. Davies, metallurgist, Goulds Foundries, Newport; C. Forrest, Junr., partner, Forrest & Sym, Manchester; A. J. Houghton, charge hand moulder, Tubal Cain Foundry, Cardiff; F. McKenning, works superintendent, Magnesium Castings and Products, Slough; A. L. Pendrey, B.Sc., metallurgical chemist, Northern Aluminium Company, Cardiff; W. Phillips, managing director, H. Pickup, Limited, Scarborough; W. S. Pratt, control chemist, Tredegar Foundry, Newport; G. M. Priestley, foundry engineer, Hy. Wallwork & Company, Manchester; S. G. Throssell, N.W. area manager, General Refractories; G. B. Wallwork, director, Hy. Wallwork, Limited, Manchester.

Transfer from Associate Member to Member

E. L. Bromige, foundry manager, International Alloys, Limited, Slough; W. E. Browning, production manager, Willey & Company, Limited, Devon; W. Y. Buchanan, foundry manager, J. Lang & Sons, Johnstone; R. Macnab, assistant foundry manager, Clyde Alloy Steel Company, Glasgow.

As Associate Members

F. M. Belfast, foreman moulder, Nigerian Railway; E. Booth, foundry foreman; G. A. Bowlzer, departmental manager, Beeston Boiler Company, Notts; A. Brayshaw, research metallurgist, Darwins, Limited, Sheffield; R. Brotherton, inspection engineer, I.C.I. (Dyestuffs); T. D. Chamberlain, foundry costing accountant, Harrison & Company, Lincoln; G. H. Davison, library secretary, United Steel Companies; A. F. Dexter, engineroom artificer, Royal Navy; G. W. Fearfield, chargehand coremaker, Leys Malleable, Derby; R. L. George, general manager, Bundaberg Foundry Company, Limited, Queensland, Australia; J. Graham, metallurgical chemist, Qualcast, Limited, Derby; P. Hamberg, development officer, B.C.I.R.A.; J. M. Houliston, chargehand, Rolls-Royce, Limited; F. Hoyle, foundry and patternshop foreman, S. Smith & Sons, Nottingham; A. E. Hughes, foreman, Phosphor Bronze Company, Birmingham; P. W. Hyde, B.Sc., foundry pupil, Fraser & Chambers, London; R. L. Kendrick, technical assistant, The Horsehay Company, Company, Limited, Wellington; F. D. Knight, head foundry foreman, Britannia Iron & Steel Company, Bedford; S. Lane, coremaker, Ley's Malleable, Derby; W. E. Mather, metallurgist, Davy & United, Sheffield; G. S. F. Murray, assistant technical officer, M.A.P., London; J. McNair, foreman moulder, Phosphor Bronze Company, Birmingham; E. Palethorpe, assistant analytical chemist, Worthington Simpson; A. H. Paterson, chief draughtsman, Scottish Precision Castings; G. Pollitt, assistant foundry foreman, Anglo-Iranian Oil; N. E. Powell, draughtsman, Crane, Limited; H. A. Prince, patternmaker (journeyman), Qualcast, Limited; E. Riorden, foundry manager, Lindops, Limited; A. Roberts, foreman, Roberts Castings, Limited; F. Rodgers, assistant metallurgist, Hadfields, Limited; J. J. Scott, B.Sc., metallurgist, Carntyne Steel Castings; G. T. Turner, foundry foreman, Phosphor Bronze Company; P. Wade, floor moulder, High Duty Alloys; G. J. Wakefield, chargehand, Ley's Malleable; G. Whettlock, foundry foreman, Glover & Wood; J. H. While, chargehand, Simplex Elec. Company;

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(*Concluded from page* 189.)

S. F. Athanikar, foundry foreman, Tata Chemicals, Belgaum, India; L. G. Brook, patternshop foreman, G.W.R. Loco Shops, Barry; C. Hampton, assistant foundry manager, J. Summers & Sons, Chester; T. F. Houlcroft, iron moulder, J. Berry, Limited, Salford; G. Leonard, chief instructor (Malleable Iron Castings), Harrison & Company, Lincoln; W. Ruffley, foreman moulder, Jackson Bros., Bolton; G. Smith, moulder, J. Chadwick, Limited, Bolton; A. Williams, sales manager (engineer), J. Williams & Sons. Cardiff; R. R. Caizley, sales manager and technical representative, Enfield Rolling Mills, Limited.

Transfer from Associate to Associate Member

R. Griffiths, foundry foreman, S. H. Russell & Sons, Leicester.

As Associates

H. Newbrook, metallurgical assistant, Sinclair Iron Company; G. R. Walker, engineering student, Bradford Technical College.

As Associate (Student)

J. Allison, apprentice draughtsman, Scottish Precision Castings.

MERWINITE IN THE SYSTEM $CaO\text{-}MgO\text{-}SiO_2$

Dr. T. W. Parker and Mr. R. W. Nurse in a Paper recently published by the Iron and Steel Institute state that merwinite has been known for some time, as both a natural and an artificial mineral, but has not been detected as a stable phase in the system $CaO\text{-}MgO\text{-}SiO_2$. The Paper establishes the primary phase field of merwinite in this system, and gives the position of the invariant points with the neighbouring fields of larnite, akermanite, monticellite and periclase. The pure mineral itself melts incongruently at 1,590 deg. C., forming $2CaO.SiO_2$ and liquid.

The application of the data to problems of dolomite-silica refractories is discussed. It is shown that compositions of this type should be completely stable to both falling and hydration under all conditions of heating and cooling, when the CaO/SiO_2 ratio is less than 1.20, but that such mixtures form relatively large percentages of melt at fairly low temperatures and hence probably not prove satisfactory refractories.

It is well known that falling blast-furnace slags can be stabilised by substituting MgO for part of the CaO in the slag composition, and, in practice, it appeared that stabilisation by this means covered a wider composition range than could be predicted on existing phase data. It is shown that the interposition of a merwinite primary field leads to deductions giving a greater agreement between theory and practice.

The data also provide confirmation of one point in Bowen's studies on the metamorphosis of siliceous limestone.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

555,814 BIRMINGHAM ELECTRIC FURNACES, LIMITED, and HARRIS, J. Furnaces for the heat-treatment of materials.

555,815 GREAT LAKES STEEL CORPORATION. Alloy steel.

555,781 TELICHOWSKI, T. Casting of metals.

555,782 MOLONEY, M. Method of strengthening structural steel or any other material of tubular form.

555,828 STANDARD TELEPHONES & CABLES, LIMITED, WOLFSON, H., and SHEPARD, S. C. Coating metals with carbon.

555,906 OCEAN SALTS (PRODUCTS), LIMITED, and PRYTHERCH, W. E. Treating magnesium dross.

555,978 BRASSERT & COMPANY, H. A., and NISSIM, R. Electric arc furnaces.

555,983 SANDVIKENS JERNVERKS AKTIEBOLAG. Process of manufacturing sintered moulded bodies of metals and alloys.

556,040 BOLTON, C. A. K., and SANDERSON BROS. & NEWBOULD, LIMITED. Production of steel alloys.

556,042 BOLTON, C. A. K., and SANDERSON BROS. & NEWBOULD, LIMITED. Production of high-speed tool steel.

556,048 SWIFT, L. J. Method of constructing basic linings for electric and other high temperature furnaces.

556,059 CONSTANTINE, W. W. (General Motors Corporation). Method of making ferrous metal articles from turnings or like scrap.

556,061 WALDRON, F. B. Manufacture of iron and steel sheets.

556,085 SIMONS, A. Method and apparatus for drawing cold metal strip or sheet.

556,098 LINDE AIR PRODUCTS COMPANY. Uniting of metals.

556,110 FOUNDRY REFRACTORIES, LIMITED, and TYRER, B. P. Furnace.

556,128 HOPE & SONS, LIMITED, H., and RINGROSE, T. H. Galvanizing and other tanks required to hold molten solids or heated liquids.

556,138 DARWINS, LIMITED, WALKER, J., and CONNERTON, D. Foundry-moulding machines.

556,197 BERK & COMPANY, LIMITED, F. W., and JONES, H. W. Process for the manufacture of a substance in powder form and the manufacture of metal agglomerates and articles therefrom.

556,202 LARSSEN, G. HAGERUP-. Furnace electrode structures.

556,354 FOSTER, H., and DONCASTER & SONS, LIMITED, D. Production of dies for drop forgings.

556,338 ASCOT GAS WATER HEATERS, LIMITED, and FRIEDMAN, L. Method of attaching metal rods or tubes to metal shells and the like.

556,406 DUFFIELD, F. L. Production of ferro-silicon.

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NEWS IN BRIEF

THE IRON AND STEEL INSTITUTE'S annual general meeting, 1944, will be held in London on May 11, it is announced.

LEES HALL & SONS, LIMITED, furnace manufacturers and consulting foundry engineers, Sutton Coldfield, have removed their main office to a more central position at Midland Drive, Sutton Coldfield, Warwickshire.

RECENT CONVERSIONS by holders of 4 per cent. convertible second mortgage debenture stock of the Indian Iron & Steel Company, Limited, into ordinary shares have reduced the amount of stock outstanding to £23,693 out of £500,000 issued in December, 1936. Holders have until December 31 next to convert.

DR. HARVEY N. DAVIS and Dr. Donald B. Keyes are on a mission to Britain from the U.S. Office of Production Research and Development, which operates under the War Production Board in Washington. They will discuss with the Ministry of Production and other Government Departments the exchange of technical information by the two countries.

RICHARDSONS, WESTGARTH & COMPANY, LIMITED, marine and electrical engineers, are offering 707,744 5s. ordinary shares at 5s. 4½d. per share to shareholders in the proportion of one new share for every five held. Treasury consent has been obtained for the issue, which is being made in connection with the redemption of the £168,206 5½ per cent. first mortgage debentures at £105 per cent.

A PAPER by Mr. N. W. Swinnerton and Dr. H. O'Neill on "Welding applied to Trackwork on the L.M.S. Railway," will be delivered at a meeting of the Institute of Welding on Wednesday, November 10, at 4 p.m., at the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1. Members are asked to note that the meeting place is not that announced in the sessional ticket.

A DEPUTATION from Jarrow Town Council has again visited the Admiralty to stress Jarrow's need for new industries to prevent another slump after the war. The deputation saw Mr. J. P. L. Thomas, M.P., Financial Secretary to the Admiralty, who stated that Jarrow would be considered when the setting up of new plants was proposed. Mr. Thomas gave out no hope, however, that the building of ships would be resumed at Jarrow.

IN ORDER to show the employees at one of the Midland works of Stewarts and Lloyds, Limited, why their particular establishment is on the Government's list of vital war factories an exhibition has been arranged in the works canteen. It has been devised and constructed by employees themselves, and as all the people employed there are familiar with ingots, the amount of steel needed to build guns, tanks and battleships has been expressed in terms of ingots instead of in terms of tons. Chief feature of the exhibition is a model showing how this particular factory is an integral part of preparations for an invasion of Europe.

PERSONAL

MR. MANSFIELD MARKHAM has resigned his seat on the board of the Wolverhampton Steel and Iron Company, Limited.

MR. W. W. WOOD was last week installed Master Cutler of Sheffield for the fourth year in succession and the fifth altogether.

MR. NORMAN BURKE and MR. CHARLES ERNEST HOLLAND ECKERSLEY have been elected to the board of James Howden & Company, Limited, engineers, of Glasgow.

MR. JOHN CLARK, Scottish representative of the Ministry of Supply, Iron and Steel Control (Scrap Section), has relinquished this appointment and also his representation of the British Iron and Steel Corporation (Scrap), Limited.

MR. JAMES JACKSON, of Walsall, who has been with the Walsall District Iron Company, Limited, iron and steel re-rollers, for 67 years, is still a traveller for the company at the age of 83. He has never missed a day except for holidays in that time.

DR. W. T. GRIFFITHS, head of the Research Department of the Mond Nickel Company, Limited, has been nominated president of the Institute of Metals, and Mr. G. L. Bailey, of the British Non-Ferrous Metals Research Association, vice-president.

MR. J. N. KILBY, general manager of the Redbourne Steelworks, Scunthorpe, of Richard Thomas & Company, Limited, has resigned his post to take a long rest on medical advice. Mr. Kilby is chairman of the Lincolnshire Ironmasters' Association and president of the Lincolnshire Iron and Steel Institute.

Will

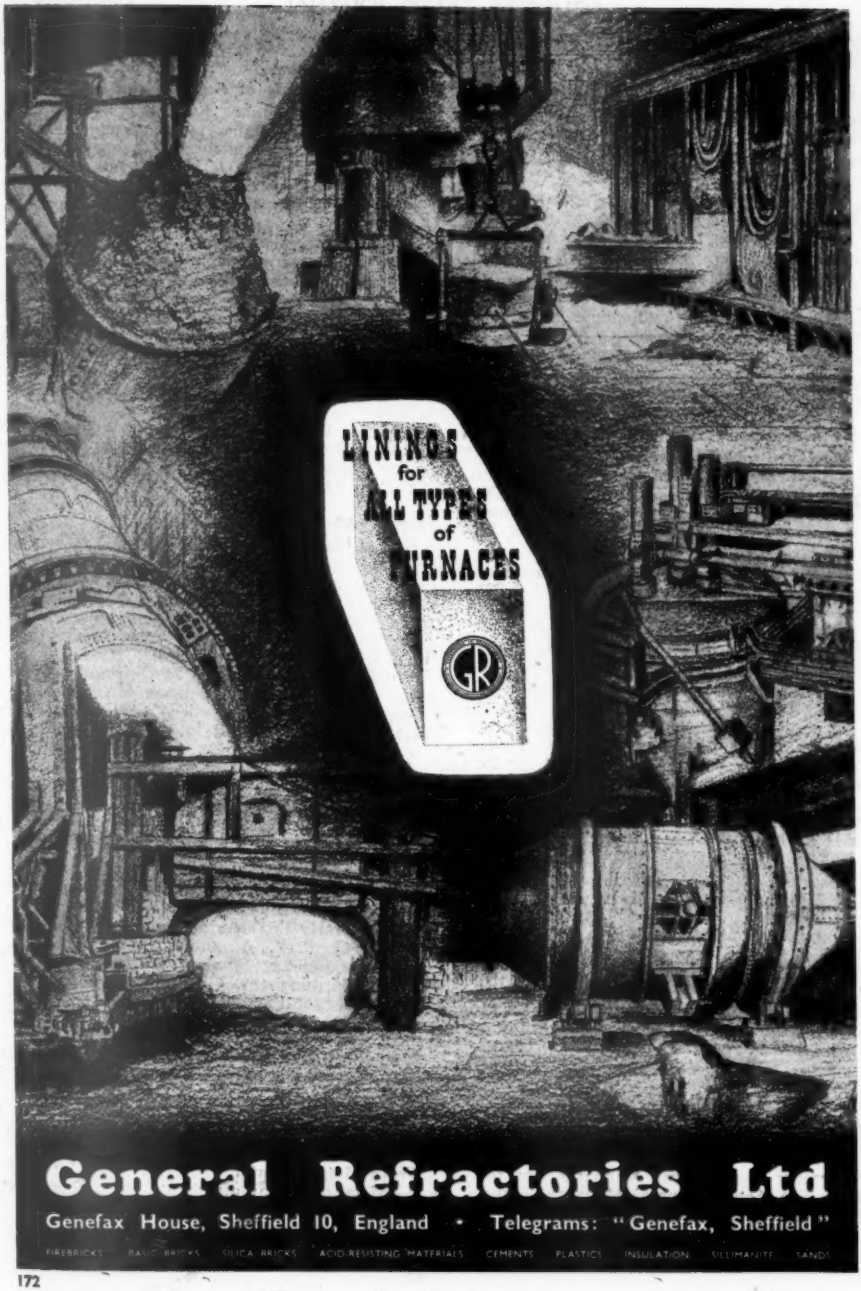
BUTLER, J. L., of Retford, managing director of W. J. Jenkins & Company, Limited, structural and gas engineers £4,209

OBITUARY

MR. JAMES WOODCOCK HEMMINGS, founder of the firm of Hemmings & Company, wire manufacturers, of Ecclesfield, Sheffield, and a director of Sheffield Steel Products, Limited, has died at the age of 64.

MR. CHARLES WILLIAM CLAXTON, managing director of the Sheffield Twist Drill and Steel Company, Limited, has died at the age of 68. Mr. Claxton joined the firm 27 years ago, and had been managing director for 17 years.

MR. HENRY JAMES SAYER, an honorary freeman of Birmingham and for two years Lord Mayor of the city, died on October 25. He was in his 87th year. Mr. Sayer was for many years a director of Joseph Lucas, Limited, and was chairman of the company from 1920 until his retirement in 1937. He was also a director of Joseph Gillott & Sons, Limited, Birmingham, makers of light metal pressings. He had a long record of public service in many spheres.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COMPANY RESULTS

(Figures for previous year in brackets)

John Rigby & Sons—Final dividend of 7½%, making 12½% (same).

Wombwell Foundry & Engineering—Final dividend of 10%, making 16% (12½%).

Cowans, Sheldon—Profit for the year ended June 30, after providing for depreciation and taxation, £21,511 (£18,063); dividend of 10% (same); to general reserve, £5,000; forward, £56,211 (£54,700).

Thos. Goldsworthy & Sons—Preparation of the accounts to June 30 has been delayed by war conditions. Directors recommend a dividend of 5% on the ordinary shares (same), absorbing with tax £7,500.

Cochran & Company (Annan)—Income for the year to June last, £58,397 (£82,495); balance after meeting general charges, £20,005 (£46,298); taxes, £12,985 (£36,954); war damage contributions, £936 (£1,601); dividend of 4%, tax free (same); forward, £961 (£877).

Herbert Morris—Profit for the year ended July 31 last, £125,445 (£127,944); interest on investments, £10,088; preference dividend for the year, £10,000; depreciation, £14,535; dividend on the ordinary shares of 20%, free of tax (same); to reserve, £10,000; forward, £67,125 (£66,711).

Blakey's Boot Protectors—Profit for the year ended June 30, after providing for depreciation and E.P.T., £39,449; income-tax, £23,431; net profit, £16,018 (£16,273); dividend on the preference shares, £292; dividend of 15% on the ordinary shares, £9,036 (same); forward, £45,136 (£38,447).

Murex—Profit for the year to June 30, 1943, £488,990 (£598,707); taxation reserve, £323,500 (£423,250); general reserve, £50,000 (same); obsolescence reserve, £25,000 (same); reserve against advances to subsidiary, £11,000 (£17,000); further reserve for investments in enemy-occupied territory, £999 (nil); final ordinary dividend of 10%, making 17½% (same), with bonus of 2½% (same); forward, £119,597 (£115,339).

Kayser, Ellison & Company—Profit to June 30, 1943, after taxation, but before taking into account income-tax to be recouped from dividends paid, and also after an additional reserve of £20,000 towards covering income-tax on all profits up to the date of the balance-sheet, £45,827 (comparable profit on old basis, £90,702, against £93,167); brought in, £11,890 (£18,473); depreciation, £15,000 (£35,000); to staff fund, £5,000 (same); final ordinary dividend of 12½%, making 17½% (same); forward, £12,842.

CONTRACT OPEN

The date given is the latest on which tenders will be accepted. The address is that from which tender forms may be obtained.

Belfast, November 4—Tramway standards, for the Town Council. The Acting General Manager, Transport Department, Sandy Row, Belfast.

LEGAL

Unauthorised Sale of Scrap Metal

At Stoke-on-Trent Stipendary Court, Gordon Bould (50), of Fairways, Uttoxeter Road, Draycott, appeared on a summons alleging the unauthorised sale of scrap metal. He pleaded not guilty to receiving a commission of £62 7s. 11d. from the firm of J. P. Griffiths, of Wolverhampton, in respect of transactions, part of which constituted a breach of the Control of Metals Order.

For the prosecution, undertaken by the Ministry of Supply, it was stated that defendant was formerly a garage owner, but since the war he had traded in metal on commission, and the firm of J. P. Griffiths was amongst those for whom he acted. It was alleged that Bould sold quantities of steel in the firm's scrap yard to two firms in the Potteries without an authorisation and received commission on the transaction.

Mr. H. Grindey, who defended, said Bould was unaware that he had contravened the regulations.

The Stipendary (Mr. MacGregor Clarkson) fined him £50, with £21 costs.

Steel Melter's £6,000 Damages

Mr. Justice Oliver, at Newcastle-upon-Tyne Assizes, entered judgment in accordance with settlement by consent for the payment of £6,000, with costs, to Frederick Stirland, first hand melter, of Middlesbrough, who claimed damages from Dorman, Long & Company, Limited, for personal injuries suffered at work on April 22, 1942.

Mr. C. Paley Scott, K.C., for Stirland, said the high figure provisionally agreed upon was due to the high wages earned. The man's legs were fractured, he was severely burned, and was in hospital eighteen months.

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

E. O. Payne, 752b, High Road, Tottenham, London, N.—Engineers. £1,000.

Norton-Harty Engineering Company, Great Bridge—£55,000. G., P., A. A., and A. T. Norton.

Lawson-Bateman, Stanley Works, Mount Street, Nechells, Birmingham—General engineers, etc. £500.

Brixton Non-Ferrous Metals—£3,000. A. E. Emblow, 62, Wellington Court, London, N.W.8, subscriber.

William Hodgkinson & Sons (Engineers), Dalestorth Street, New Cross, Sutton-in-Ashfield—£500. R. C. Keetch.

Salt Engineering Company (Coventry), 68, Little Park Street, Coventry—£1,000. H. W. and D. W. Salt and E. Tolchard.

Wrays Metals (Southport), 12, Virginia Street, Southport—Metal and scrap merchants, etc. £2,000. A. H., M., G., and T. Wray.

"...that Freedom shall not perish from the earth"

It is a sacred duty to give generously in remembrance of all those who fought and suffered in the last war and those who are serving their country in the present struggle for Liberty. Amongst the latter we gratefully acknowledge the courage and sacrifice of our 4,400 employees in H. M. Forces.

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THE UNITED STEEL COMPANIES LTD

Raw Material Markets

IRON AND STEEL

Works are well provided with high-phosphorus ores, and this is reflected in the abundant supply of foundry and basic iron. On the other hand, ironmasters insist that the improvement in the imports of high-grade foreign ores still falls short of their needs. Some increase in the output of low and medium phosphorus irons has been possible, and as refined iron is also more readily obtainable than was the case in the third quarter of the year, the difficulties which have attended the production of special castings in the heavy engineering and allied foundries have been correspondingly reduced. The chief bottleneck in the iron trade is the continued scarcity of hematite. For approved purposes the Control is releasing limited tonnages under licence, but the use of this grade is subject to the strictest supervision.

Re-rolling plants are engaged in very extensive programmes for various phases of the war effort, and to sustain this high level of activity, they need heavy tonnages of steel semis. Subject only to occasional delays through transport difficulties, British steelworks are maintaining good deliveries of primes and defectives, and there has been little need of late to encroach upon stocks of American material.

All finished steel products with the exception of heavy joists are in strong request, and, as heretofore the chief demand is for steel plates in all gauges. Active steps are in hand to increase the plate mill capacity, but in the meantime it would have been impossible to avoid an embarrassing shortage of supplies had it not been for the invaluable assistance of the sheet mills. Sheet makers have also extensive contracts for heavy gauges of sheets for shipbuilding, and bookings for light sections, small bars, etc., are on a no less substantial scale. Engineering establishments, railways and collieries are all imposing substantial demands on the steel mills, and among the lighter branches of the industry wire mills and rivet works are exceptionally busy. Consumption of high grade alloy steel is maintained at a good level, but a less consistent demand suggests that producers are overtaking requirements.

NON-FERROUS METALS

So long as hostilities continue, it is hardly likely that a surplus of any one of the non-ferrous metals will develop, for consumption for war purposes must be on a very large scale indeed. It is not possible at this stage to make definitive plans for the period after the war, but it is natural that producers should now be looking ahead and surveying the possibilities of disposing of a war-expanded output. The research organisations established by various metal interests will have a big part to play in re-establishing peacetime conditions.

Speaking at the tenth annual meeting of the Copper Development Association, Mr. E. Pam said that during the past ten years the Association had emerged from the experimental stage and could now be regarded as an institution that had come to stay, the need for which would in the future most certainly be greater than ever before. Copper would undoubtedly be faced with greater competition from other materials than in any period hitherto and would require the backing of all the research and development that could be brought to bear. In addition, many set-backs resulting from wartime conditions would have to be made good. Since the outbreak of war the Association's activities had of necessity been greatly curtailed, but an active nucleus had been maintained which was capable of quick expansion. It was necessary that vigorous expansion should take place at the earliest opportunity and that the activities of the Association should be developed to an extent even greater than that prevailing before the war.

The tin producers also have a strong and well-established research organisation, and their task, perhaps, will be harder than that of any comparable organisation in the metal industry. The loss of the Malayan tinfields has necessitated the use of substitute materials for tin in many directions, and some of these substitutes may be found after the war to have dug themselves in very securely.

Zinc and lead may have less difficulty in re-establishing themselves: certainly in the immediate post-war years there will be a big demand for both metals. The building industry alone will require large tonnages of lead in the form of pipes, sheets, etc.

Hardware Prices Controlled

The Board of Trade have made an Order controlling prices for hardware, ironmongery and certain other household goods from November 15. Manufacturers may not charge more than they were lawfully charging on August 31. Wholesalers and retailers are allowed fixed margins of profit on cost.

American Finished Steel Output

According to the American Iron and Steel Institute, finished rolled iron and steel produced for sale during the first six months of this year, after deducting 2,441,030 tons delivered to members of the industry for conversion into further finished products, amounted to 30,804,043 tons. This compares with a production of 30,552,339 tons for the corresponding period in 1942. Steel plate production during the first half of this year increased substantially over 1942, amounting to 6,399,825 tons, as compared with 5,173,772 tons last year. Among the other principal items of production, small increases were scored in bars, pipe and tube, and strip steel, while decreases in varying amounts are shown in structural shapes, wire products, sheets and tinplate. The reduction in the last mentioned was the greatest, output dropping from 1,765,631 tons in the first half of 1942 to 1,085,810 tons in the first six months of 1943.

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Railway engineers are already at work on the new possibilities. Necessary strength with but a fraction of the weight means saving in power and in maintenance too, both of train and permanent way. So, just when competition with air travel becomes keenest, light alloys may solve the railways' problem of high speed at low cost. Here's another case where 'INTAL', as makers of aluminium alloys for every conceivable purpose, look forward to helping.

KAISER TRAINS
After the War

San Francisco, Tuesday — Mr. Henry J. Kaiser, the American record shipbuilder, said he is negotiating with a group of U.S. railway companies to build, after the war, fast, light-weight trains in yards now turning out ships. Some of these trains, built of new steel alloys and aluminium and magnesium, will have streamlined passenger coaches and will be so light that one engine will pull twice the number of cars now generally used.—Reuter.

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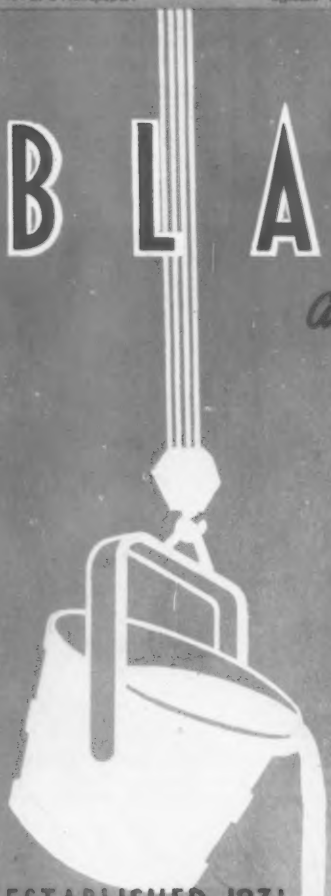

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